

ABSTRACT OF THE DISCLOSURE

Systems and methods for three dimensional lithography, nano-indentation, and combinations thereof are disclosed. One exemplary three dimensional lithography method, among others, includes: providing a substrate having at least one optical element, wherein the optical element is selected from a refractive element and a diffractive element; disposing a polymer layer on the substrate and the at least one optical element, wherein the polymer layer includes a polymer material selected from a positive-tone polymer material and a negative-tone polymer material; positioning a mask adjacent the polymer layer, wherein the mask does not cover at least one directly exposed portion of the polymer material directly overlaying the at least one element; and exposing the at least one directly exposed portion of the polymer material to optical energy, wherein the optical energy passes through the at least one directly exposed portion of the polymer material and interacts with the element, and the element redirects the optical energy through the polymer material forming at least one area of indirectly exposed polymer material.